Simpson

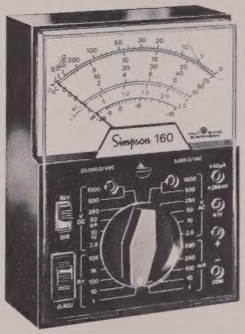
INSTRUMENTS THAT STAY ACCURATE

# OPERATOR'S MANUAL

## MODEL 2800
## DIGITAL PANEL INSTRUMENTS

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie St., Chicago, Illinois 60644
Area Code 312, Telephone 379-1121
In Canada, Bach-Simpson, Ltd., London, Ontario

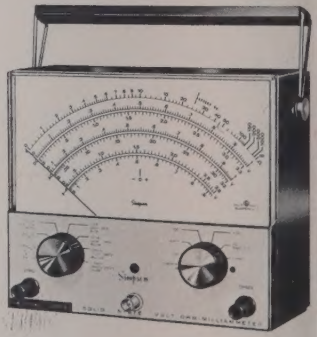
# new VOM's from Simpson




## 160 Handi-VOM®

**Just 3 5/16" Wide . . .**
**with Full-Size VOM Features**

- 20,000 Ω VDC . . . 5,000 Ω VAC
- ±2% DC . . . ±3% AC
- 5 Resistance Ranges . . . Plus a 0-250 DC Millivolt Range



## 313 Solid-State VOM

**VTVM Features . . . VOM Conveniences**

- Uses a single 9-volt battery
- 10 Meg Ω DC . . . 11 Meg Ω AC
- Large 7" scale

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**Simpson has over 1,400 stock sizes and types of panel meters, too!**

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# OPERATOR'S MANUAL

## MODEL 2800
## DIGITAL PANEL INSTRUMENTS

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**5200 W. Kinzie St., Chicago, Illinois 60644**
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5-113895

FIGURE 1-1 MODEL 2800

## SECTION I
## GENERAL INFORMATION

The Simpson Model 2800 Digital Panel Instrument is a panel mounted single range instrument designed to indicate input DC voltages and DC currents by means of a non-blinking numerical display. Besides being used as a replacement for analog-type meters and panel indicators, this 3-1/2 digit instrument is suitable for indicating quantities such as temperature, pressure and angular rotation with the use of a transducer or converter.

The Model 2800 is available in ten models which consist of five DC voltage ranges and five DC current ranges with 0.1% measurement accuracy. Maximum indication of these instruments are 199.9mV, 1.999V, 19.99V, 199.9V, 1010V, 19.99uA, 199.9uA, 1.999mA, 19.99mA, and 199.9mA.

The analog-to-digital conversion technique utilized in the Model 2800 is dual-slope integration. By combining maximum utilization of integrated circuits and this technique, a high order of accuracy and reliability is achieved.

Standard features of this instrument include: fast sampling rate of 5 per second, non-blinking display with BCD storage, and flashing indicators for underrange and out of range inputs. With a linear 15% underrange measurement capability, a high degree of resolution in measurements of input values around zero is achieved.

Special available options of this instrument are: 1, 2, 4, 8 integrated circuit compatible BCD output, high input impedance in DC voltage models, and unit without power supply.

## SPECIFICATIONS

DC Voltage Ranges

| Range | Maximum Indication | Input Impedance | Catalog Number |
|---|---|---|---|
| 0-99.9mV DC | 199.9mV | 10 K Ω | 22950 |
| 0-.999V DC | 1.999V | 100 K Ω | 22951 |
| 0-9.99V DC | 19.99V | 1 M Ω | 22952 |
| 0-99.9V DC | 199.9V | 1 M Ω | 22953 |
| 0-999V DC | 1010V | 1 M Ω | 22954 |

DC Current Ranges

| Range | Maximum Indication | Voltage Drop | Catalog Number |
|---|---|---|---|
| 0-9.99uA DC | 19.99uA | 50mV | 22955 |
| 0-99.9uA DC | 199.9uA | 50mV | 22956 |
| 0-.999mA DC | 1.999uA | 50mV | 22957 |
| 0-9.99mA DC | 19.99mA | 50mV | 22958 |
| 0-99.9mA DC | 199.9mA | 50mV | 22959 |

ACCURACY: 0.1% of full scale ± 1 digit from +15°C to +35°C.
STABILITY: Within accuracy specification for 24 hours.
RESOLUTION: 1 part in 1000.
CONVERSION RATE: 5 conversions per second continuous.
OVERRANGE: Linear to 100% overrange.
UNDERRANGE: Linear to 15% underrange by reading the complement.
DISPLAY: Non-blinking with storage.
COMMON MODE REJECTION: > 90 DB at 60Hz—with 1 K Ω unbalance.
SERIES MODE REJECTION: > 35 db at 60Hz.
TEMPERATURE RANGE: 0°C to +50°C.
POWER REQUIREMENT: 115/230V AC ±10%
50-60Hz, 9VA (nominal).
WEIGHT: 2.5 lbs.
SIZE: 6.381 L x 4.870 W x 3.125 H.
(See Figure 1-2)

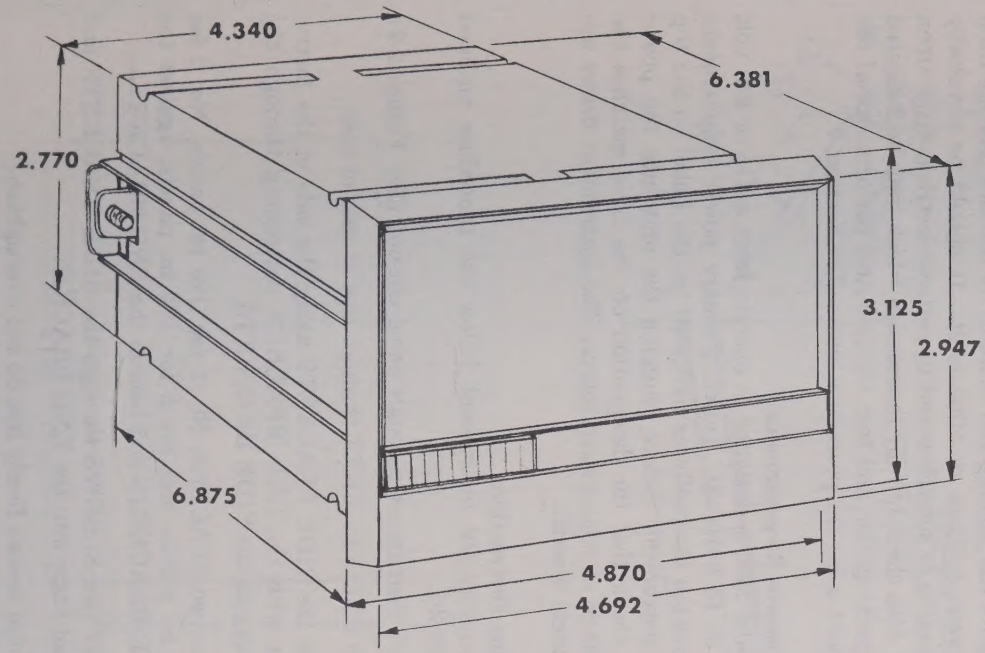



FIGURE 1-2 MODEL-2800 DIMENSIONAL DRAWING

## SECTION II
## UNPACKING AND INSTALLATION

**Incoming Inspection**

Notify the shipper if there is any sign of external damage. If not, remove the packing and examine for obvious damage from shock, water leakage, or other faults. It should be physically free of marks or scratches and in perfect electrical order upon receipt. Also check for any accessories which may be indicated on the packing slip, and test the electrical performance of the instrument using the procedure outlined in Section V.

**Power Source Requirements**

The Model 2800 is designed to operate from a 115 or 230 volt ±10%, 50 to 60Hz AC source. Primary power requirements are connected internally as indicated by the Label on the top of the instrument. Before plugging the unit into the power source, check that the designation on the lable matches the line voltage of your power source. The instrument draws approximately 9 watts.

**Mounting Instructions**

For mounting the instrument follow the procedure outlined in Figure 2-1.

1. Insert instrument through panel cut-out (See Figure 2-2).
2. Slide END BRACKET through slot at rear of case.
3. Place the SIDE BRACKETS along the side of the instrument with the END BRACKET protruding through the opening in the SIDE BRACKETS.
4. Place two SPACERS, No. 1 for .125 in. panels, No. 2 for .090 in. panels, and No. 3 for .062 in. panels, against the SIDE BRACKETS and behind the END BRACKET.
5. Insert two SCREWS through the SIDE BRACKETS and thread them into the END BRACKET.
6. Tighten screws firmly but do not overtighten.

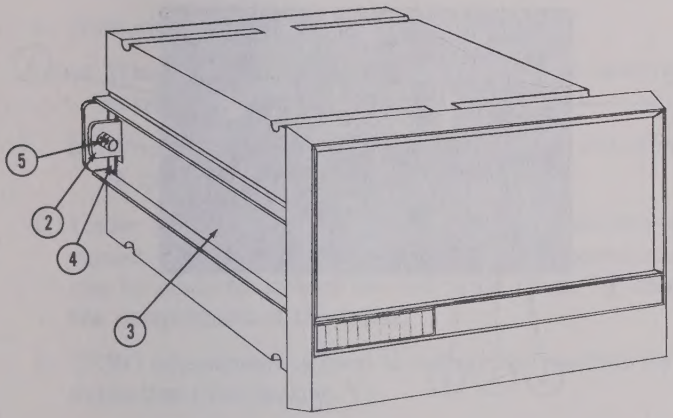



FIGURE 2-1 PANEL MOUNTING

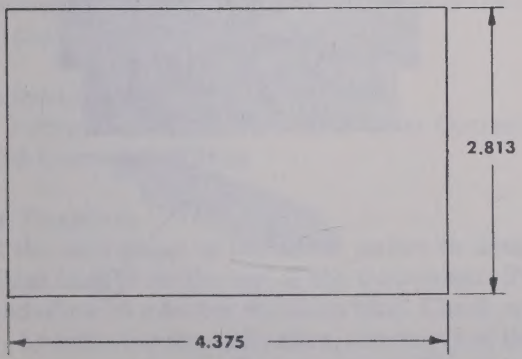



FIGURE 2-2 PANEL CUTOUT DIMENSIONS

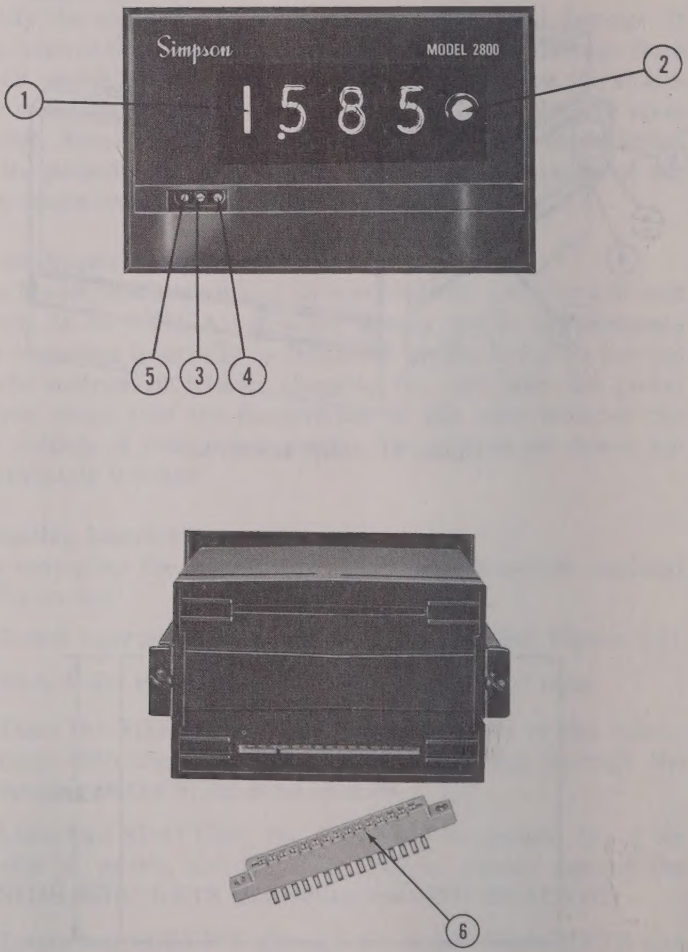



FIGURE 3-1 FRONT AND REAR PANEL DESCRIPTION

## SECTION III
## OPERATING INSTRUCTIONS

A. Front and Rear Panel Description

1. Numerical "1" Indicator—

   a) When illuminated steadily indicates the instrument is reading full scale or above.

   b) When flashing indicates that the input is out of range of the instrument.

2. Under Range Indicator—when flashing indicates a reversed input polarity. Reverse polarity measurements can be made to 15% of the full scale range by reading the complement of the input.

3. ZERO adjustment is used to adjust the readout for 000 indication (See Section V).

4. OFFSET adjustment is used to compensate for internal circuit offset. It is adjusted for a readout indication of 000 with the input open or shorted.

5. RANGE adjustment is used to calibrate the instrument along with the ZERO and OFFSET adjustments.

6. The CONNECTOR provides a means for connecting input power and signal and for BCD outputs to the instrument (See Figure 3-2. Connector Wiring).

B. Rear Connector Wiring and Designation
For the wiring and designations of the Rear Connector see Figure 3-2 Connector Wiring.

C. Turn On Procedure
Connect the instrument to the power source as designated on the label located on the top of the instrument. Turn on power and allow 15 minutes warm-up time. Check zero and accuracy by following the calibration, accuracy and linearity check procedures in Section V Maintenance. The unit is now ready for use in the circuit for which it was intended.

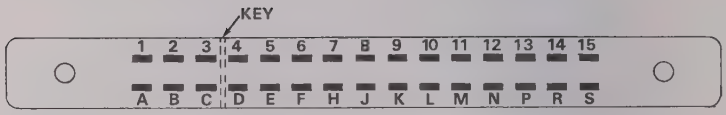



FIGURE 3-2 CONNECTOR WIRING

| Contact Number | Connection | Contact Number | Connection |
|---|---|---|---|
| 1 | | A | +200V DC* |
| 2 | | B | |
| 3 | | C | Vcc (+3.8V DC)* |
| 4 | | D | Gnd.* |
| 5 | | E | |
| 6 | | F | −12V DC* |
| 7 | | H | +Input |
| 8 | | J | |
| 9 | | K | −Input |
| 10 | | L | |
| 11 | | M | +12V DC* |
| 12 | | N | |
| 13 | | P | 115V AC |
| 14 | | R | |
| 15 | Pwr. Line Gnd. | S | 115V AC (HOT) |

*NOTE: Connection to these terminals is to be made only when using an external power supply.

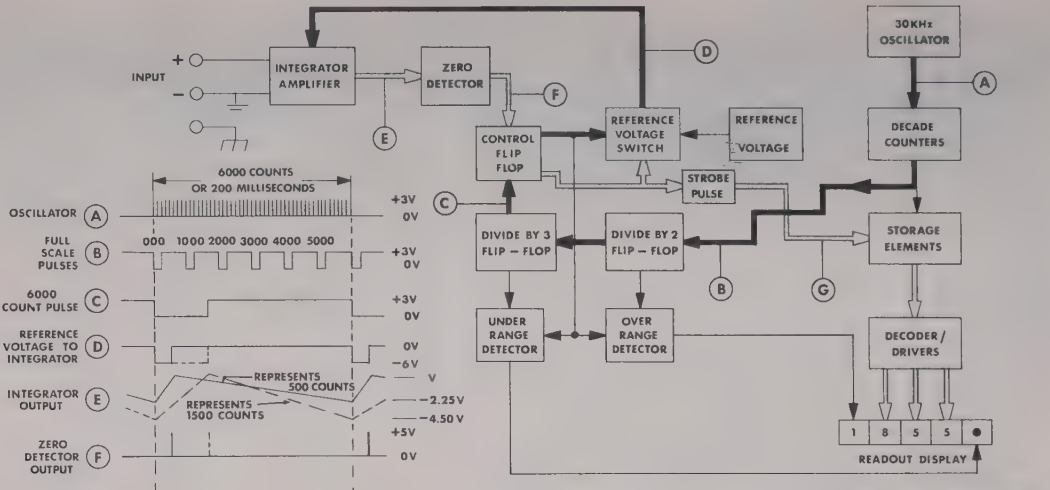
## SECTION IV
## THEORY OF OPERATION

The Model 2800 utilizes the dual-slope integration principle as its analog-to-digital converter. This measuring technique combines the inherent high noise rejection of integration with the accuracy and stability of comparing to an internal precision reference. Over a continuous measurement cycle, the digital representation of the input signal is determined by obtaining the ratio of the unknown input signal and the known reference signal over a fixed period which is determined by a fixed number of clock pulses.

Each measurement cycle consists of two parts. During the first part, the integrating capacitor is charging at a rate proportional to the input signal while clock pulses feed continuously into the counters. At 6000 counts, the divide by 3 Counter changes state (See Timing Diagram on Figure 4-1) and the second part of the measurement cycle begins.

At time $t_0$ (or 6000 counts), the negative going edge of the divide by 3 Counter triggers the Control Flip-Flop which in turn switches the Reference Voltage to the Integrator/Amplifier. At this time, the integrating capacitor starts to discharge at a rate proportional to the Reference Voltage minus the unknown input voltage. When the output of the Integrator/Amplifier reaches zero volts ($t_1$), the Zero Detector resets the Control Flip-Flop which then turns off the Reference Voltage and produces a strobe pulse. The strobe pulse temporarily disables the clock and at the same time transfers the count of the Decade Counters to the Storage Elements at that particular instant. Once the Storage Elements have received the particular count, direct visual readout is obtained through the Decoder/Drivers.

After the completion of the strobe pulse, which is approximately 10 microseconds wide, the clock circuit resumes generating pulses and the measurement cycle repeats. The input voltage again charges the integrating capacitor until the 6000 count pulse is generated. The measurement cycle is continuous.




TIMING DIAGRAM

FIGURE 4-1 SIMPLIFIED BLOCK DIAGRAM

The objective of the measurement cycle is to determine the time-ratio of the 6000 count period devoted to charging and discharging the integrating capacitor. The measured and displayed value is the number of clock pulses counted during the discharge-to-zero portion of the cycle. Since the charging and discharging cycles use the same RC components and clock pulses, the measured value is totally unaffected by their absolute values, provided only that these remain stable during the measurement cycle. Therefore, this measuring technique eliminates the need for a precision integrator and high stability oscillator. Since the Reference Voltage is the only important error source, a low TC Zener diode is used to ensure its stability.

The Underrange Detector is used to sense the polarity of the input signal using digital means. The polarity of the input signal is determined by the state of the Control Flip-Flop at count 0000 using the negative going edge of the divide by 3 Counter as the reference.

The Overrange Detector satisfies the following conditions:

1. Extinguishes the "1" lamp when the readout is less than 1000 counts.
2. Illuminates the "1" lamp when the readout is between 1000 and 1999 counts.
3. Flashes the "1" lamp when the readout exceeds 1999 counts.

Like the Underrange Detector, each of the above three conditions is determined by the state of the Control Flip-Flop at a particular count of the Decade Counters using the negative going edge of the divide by 3 Counter as the reference.

## SECTION V
## MAINTENANCE & PRELIMINARY CHECKOUT

The Model 2800, being a solid state instrument, requires little or no maintenance other than occasional recalibration. If repairs are required, other than fuse replacement, connector wiring or replacement of parts with obvious damage, the instrument should be shipped to one of the Simpson Authorized Repair Centers as listed at the end of this manual.

**Zero Adjustment and Calibration**

1. Apply AC power to the Model 2800 and the calibration equipment allowing a minimum of 15 minutes for warm-up.
2. With the input connections open adjust the ZERO potentiometer for a reading of 000 with the numerical "1" indicator and Underrange indicator extinguished. (If the Underrange indicator is flashing, adjust the potentiometer CCW. If the Underrange indicator is off, and the reading is not 000, adjust the potentiometer CW. See Figure 3-1 Front and Rear Panel Description).
3. Short the input connections and adjust the OFFSET potentiometer for 000.
4. Connect the calibration equipment output to the input of the Model 2800 (See Figure 3-2 Connector Wiring).
5. Set the calibration equipment for the proper calibration output as indicated in Table 5-1 for voltage and Table 5-2 for current.
6. Adjust the RANGE potentiometer until the readout indicates the value as given in Table 5-1 and Table 5-2.
7. Repeat steps 2 through 6 until conditions are obtained for 000 reading with the input connections open and shorted and the correct reading with the proper calibration output applied as given in Table 5-1 and Table 5-2.

| Model 2800 Reading | Calibration Output (volts) | Instrument Range | Catalog No. |
|---|---|---|---|
| 150 mV | .1500 | 0-100 mV | 22950 |
| 1.50 V | 1.500 | 0-1 V | 22951 |
| 15.0 V | 15.00 | 0-10 V | 22952 |
| 150 V | 150.0 | 0-100 V | 22953 |
| 900 V | 900.0 | 0-1000 V | 22954 |

TABLE 5-1 VOLTAGE CALIBRATION CHART

| Model 2800 Reading | Calibration Output (mA) | Instrument Range | Catalog No. |
|---|---|---|---|
| 15.0 uA | .0150 | 0-10 uA | 22955 |
| 150 uA | .1500 | 0-100 uA | 22956 |
| 1.50 mA | 1.500 | 0-1 mA | 22957 |
| 15.0 mA | 15.00 | 0-10 mA | 22958 |
| 150 mA | 150.0 | 0-100 mA | 22959 |

TABLE 5-2 CURRENT CALIBRATION CHART

**Accuracy and Linearity Check**

To check accuracy and linearity of the Model 2800 use Table 5-3 for the voltage range instruments and Table 5-4 for the current range instruments.

| Model 2800 Reading (1) | | Calibration Output (Volts) to Instrument Catalog Numbers | | | | |
|---|---|---|---|---|---|---|
| Min. | Max. | 22950 | 22951 | 22952 | 22953 | 22954 |
| 898(2) | 902(2) | —.0100 | —.1000 | —1.000 | —10.00 | —100.0 |
| 998(2) | 002 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 098 | 102 | .0100 | .1000 | 1.000 | 10.00 | 100.0 |
| 498 | 502 | .0500 | .5000 | 5.000 | 50.00 | 500.0 |
| 798 | 802 | .0800 | .8000 | 8.000 | 80.00 | 800.0 |
| 998 | 1002 | .1000 | 1.000 | 10.00 | 100.0 | 1000 |
| 1198 | 1202 | .1200 | 1.200 | 12.00 | 120.0 | (3) |
| 1498 | 1502 | .1500 | 1.500 | 15.00 | 150.0 | (3) |
| 1898 | 1902 | .1900 | 1.900 | 19.00 | 190.0 | (3) |

NOTES: (1) No decimals are included as the numerical readout is the same in all cases.

(2) Reading is the Full Scale complement

(3) Maximum input is 1000V

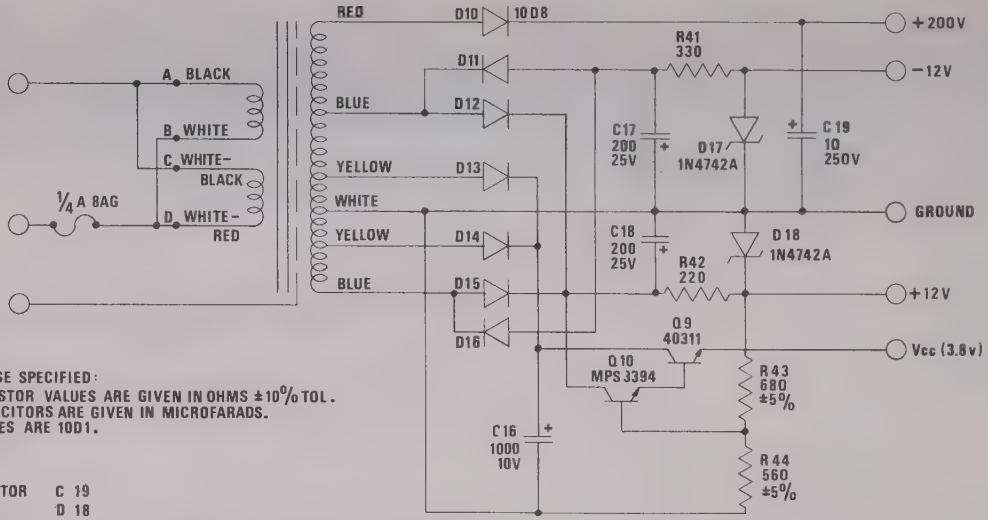
TABLE 5-3 VOLTAGE ACCURACY AND LINEARITY CHART

| Model 2800 Reading (1) | | Calibration Output (mA) to Instrument Catalog Numbers | | | | |
|---|---|---|---|---|---|---|
| Min. | Max. | 22955 | 22956 | 22957 | 22958 | 22959 |
| 898(2) | 902(2) | —.0010 | —.0100 | —.1000 | —1.000 | —10.00 |
| 998(2) | 002 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 098 | 102 | .0010 | .0100 | .1000 | 1.000 | 10.00 |
| 498 | 502 | .0050 | .0500 | .5000 | 5.000 | 50.00 |
| 798 | 802 | .0080 | .0800 | .8000 | 8.000 | 80.00 |
| 998 | 1002 | .0100 | .1000 | 1.000 | 10.00 | 100.0 |
| 1198 | 1202 | .0120 | .1200 | 1.200 | 12.00 | 120.0 |
| 1498 | 1502 | .0150 | .1500 | 1.500 | 15.00 | 150.0 |
| 1898 | 1902 | .0190 | .1900 | 1.900 | 19.00 | 190.0 |

NOTES: (1) No decimals are included as the numerical readout is the same in all cases.

(2) Reading is Full Scale complement.

TABLE 5-4 CURRENT ACCURACY AND LINEARITY CHART




UNLESS OTHERWISE SPECIFIED:
ALL RESISTOR VALUES ARE GIVEN IN OHMS ±10% TOL.
ALL CAPACITORS ARE GIVEN IN MICROFARADS.
ALL DIODES ARE 10D1.

LAST: CAPACITOR C 19
DIODE D 18
RESISTOR R 44
TRANSISTOR Q 10

FOR 117 VOLT OPERATION, CONNECT JUMPERS FROM A TO C AND B TO D.

FOR 234 VOLT OPERATION, CONNECT JUMPER FROM B TO C.

FIGURE 5-1 SCHEMATIC DIAGRAM, POWER SUPPLY

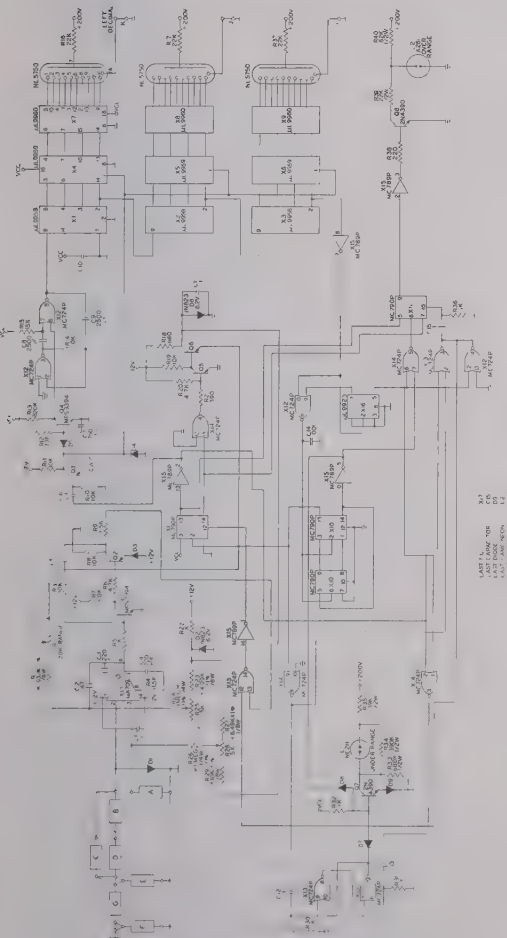


FIGURE 5-2 SCHEMATIC DIAGRAM, DIGITAL AND CONTROL CIRCUIT

## Digital and Control P.C. Board Assembly

| Symbol | Part Number | Description |
|---|---|---|
| X1, X2, X3 | 5-113188 | I.C. Decade Counter |
| X4, X5, X6 | 5-113863 | I.C. Buffer Storage Element |
| X7, X8, X9 | 5-113189 | I.C. Decoder Driver |
| X10, X11 | 5-113190 | I.C. Dual J-K Flip-Flop |
| X12, X13, X14 | 5-113186 | I.C. Quad 2-Input Gate |
| X15 | 5-113191 | I.C. Hex Inverter |
| X16 | 5-113983 | I.C. J-K Flip-Flop |
| X17 | 5-113642 | I.C. Operational Amplifier |
| Q1, Q4 | 5-112631 | Transistor, MPS 3394 |
| Q2, Q3, Q5, Q6 | 5-113864 | Transistor, MPS 3702 |
| Q7, Q8 | 5-112632 | Transistor, 2N4390 |
| D1, D3, D4, D5, D7, D8, D9 | 5-112004 | Diode, Silicon, 1N914 |
| D2, D6 | 5-111247 | Diode, Reference, 1N823 |
| R38 | 5-113867 | Resistor, 220Ω, ±10%, 1/4 Watt |
| R21 | 5-113868 | Resistor, 390Ω, ±10%, 1/4 Watt |
| R18 | 5-113869 | Resistor, 680Ω ±10%, 1/4 Watt |
| R13 | 5-113870 | Resistor, 820Ω, ±10%, 1/4 Watt |
| R5, R22, R30, R31, R32, R36 | 5-113871 | Resistor, 1KΩ, ±10%, 1/4 Watt |
| R4, R9 | 5-113872 | Resistor, 1.5KΩ, ±10%, 1/4 Watt |
| R6, R20 | 5-113873 | Resistor, 4.7KΩ, ±10%, 1/4 Watt |
| R23 | 5-113030 | Resistor, 4.99KΩ, ±1%, 1/8 Watt |
| R27 | 5-113987 | Resistor, 6.49KΩ, ±1%, 1/8 Watt |
| R3, R7, R8, R10, R11, R14, R19 | 5-113624 | Resistor, 10KΩ, ±10%, 1/4 Watt |
| R29 | 5-113631 | Resistor, 10KΩ, ±1%, 1/8 Watt |
| R15 | 5-113621 | Resistor, 15KΩ, ±10%, 1/4 Watt |
| R16, R17, R37 | 5-113623 | Resistor, 22KΩ, ±10%, 1/4 Watt |
| R39 | 1-113439 | Resistor, 22KΩ, ±10%, 1/2 Watt |
| R12 | 5-113875 | Resistor, 33KΩ, ±10%, 1/4 Watt |
| R35 | 1-115613 | Resistor, 39KΩ, ±10%, 1/2 Watt |
| R40 | 1-113948 | Resistor, 82KΩ, ±10%, 1/2 Watt |

## Replaceable Parts

| Symbol | Part Number | Description |
|---|---|---|
| R1 | 5-113877 | Resistor, 93.1KΩ, ±1%, 1/8 Watt |
| R34 | 5-113878 | Resistor, 390KΩ, ±10%, 1/2 Watt |
| R33 | 1-114346 | Resistor, 680KΩ, ±10%, 1/2 Watt |
| R24, R26 | 5-113879 | Resistor, 1MΩ, ±1%, 1/4 Watt |
| R25, R28 | 5-113880 | Potentiometer, 5KΩ, Wirewound |
| R2 | 5-113881 | Potentiometer, 20KΩ, Wirewound |
| C3, C4 | 5-112691 | Capacitor, 220 pfd, ±20% |
| C7 | 5-113882 | Capacitor, 750 pfd, ±10% |
| C14 | 1-111119 | Capacitor, 0.001 ufd, ±20% |
| C8, C9 | 5-113985 | Capacitor, 2500 pfd, ±20% |
| C6 | 5-113215 | Capacitor, 0.01 ufd, ±20% |
| C5, C10, C11, C12, C13, C15 | 5-113214 | Capacitor, 0.1 ufd, −20% +80% 10V |
| C1 | 5-113883 | Capacitor, 0.1 ufd, −20% +80%, 30V |
| C2 | 5-113884 | Capacitor, 0.47 ufd, ±10%, 75V |
| | 5-113888 | Tube, Readout, NL-5750 (Special) |
| L1 | 5-111505 | Lamp, Neon, NE-2H |
| L2 | 5-113889 | Lamp, Neon, Numerical 1, A261 |
| | 5-113331 | Capsule, Neon, Red |
| | 10-861916 | Baffle, Readout |
| | See Table 6-1 | Digital and Control P.C. Board Ass'y. |

NOTE: For range components see the chart on FIGURE 5-1, Schematic Diagram

## Power Supply P.C. Board Assembly and Case

| Symbol | Part Number | Description |
|---|---|---|
| Q9 | 5-113195 | Transistor, 40311 |
| Q10 | 5-112631 | Transistor, MPS 3394 |
| D10 | 5-114006 | Diode, Silicon, 10 D8 |
| D11, D12, D13, D14, D15, D16 | 5-114005 | Diode, Silicon, 10 D1 |
| D17, D18 | 5-113866 | Diode, Zener, 1N4742A |

## Power Supply P.C. Board Assembly and Case (Cont'd)

| Symbol | Part Number | Description |
|---|---|---|
| R42 | 1-115612 | Resistor, 220Ω, ±10%, 1/2 Watt |
| R41 | 1-110645 | Resistor, 330Ω, ±10%, 1/2 Watt |
| R44 | 1-118574 | Resistor, 560Ω, ±5%, 1/2 Watt |
| R43 | 5-114035 | Resistor, 680Ω, ±5%, 1/2 Watt |
| C19 | 5-113887 | Capacitor, 10 ufd, 250V DC |
| C17, C18 | 5-113886 | Capacitor, 200 ufd, 25V DC |
| C16 | 5-113885 | Capacitor, 1000 ufd, 10V DC |
| | 5-113890 | Transformer |
| | 5-112727 | Heatsink |
| | 5-113997 | Fuse, 1/4 Amp. 8AG U/L |
| | 10-861913 | Power Supply P.C. Board Ass'y. |
| | 5-114030 | Case, Half, (2 per unit) |
| | 10-560164 | Cover, Assembly |
| | 5-114026 | Bracket, Side |
| | 5-114027 | Bracket, End |
| | 5-114031 | Spacer #3 |
| | 5-114032 | Spacer #2 |
| | 5-114033 | Spacer #1 |
| | 5-113895 | Instruction Manual |

## Replaceable Parts

TABLE 6-1 Digital & Control P.C. Assemblies

| Instrument Range | Catalog Number | Digital and Control P.C. Assembly Number |
|---|---|---|
| 0-100 mV | 22950 | 10-861958 |
| 0-1 V | 22951 | 10-861959 |
| 0-10 V | 22952 | 10-861960 |
| 0-100 V | 22953 | 10-861961 |
| 0-1000 V | 22954 | 10-861962 |
| 0-10 uA | 22955 | 10-861963 |
| 0-100 uA | 22956 | 10-861964 |
| 0-1 mA | 22957 | 10-861965 |
| 0-10 mA | 22958 | 10-861966 |
| 0-100 mA | 22959 | 10-861967 |

## Definition of Terms

**Analog** – A term referring to the measurement of a quantity where infinite resolution is possible. A D'Arsonval type panel meter is an example.

**B C D Output** – (Binary coded decimal) A series of electrical pulses which represent code in the binary number system. This code corresponds to the decimal number shown on the Model 2800 readout and is frequently used for recording the number displayed on tape in binary coded form.

**Common Mode Rejection** – The ability to reject any undesired signal or noise that is injected into the measurement circuit of the unit as the result of conversion of noise voltages common to both input leads.

**Complement** — A number which when added to another number completes it to a full value. The 2800 reads out the complement of the full scale value for all negative polarity inputs. For example, a −1.25 volt input on the 9.99 volt full scale range would read out as 8.75 and −0.75 volts would read out as 9.25.

**Digital** — A system such as the 2800, where measurements are made in increments with the resolution limited to the number of digits utilized, as compared to the infinite resolution of the analog system. This does not mean that the analog method is more accurate because with it, the human error in reading is present.

**Overrange** — The full scale of a digital measurement instrument is clearly specified at a given value such as 9.99 volts. Overrange is defined as the per cent of full scale which can be added to the specified full scale value and read out accurately. The 2800 circuitry allows 100% overrange which means the 9.99 volt range is accurate to 19.99 volts.

**Resolution** — The smallest incremental change that can be detected. The resolution of the Model 2800 is 0.1% of full scale.

**Series Mode Rejection** — The ability to reject any undesired signal or noise voltages that exists between the positive and negative input leads of the measurement circuit. Any noise superimposed upon the signal is considered series mode noise.

**Storage** — Solid state memory elements which hold the representation of the readout value until changes occur. Consequently, a steady input signal results in a non-blinking readout since the readout tubes and their Decoder/Drivers obtain these signals from the storage elements.

**Underrange** — When the polarity of the input reverses from standard (as shown on pins H and K on the connector) the 2800 is considered to be operating underrange. The underrange capability of the instrument is 15% of full scale.

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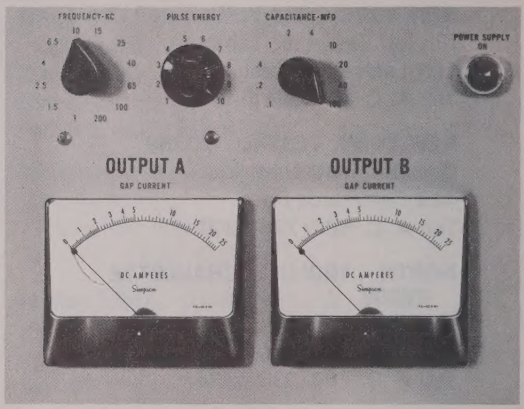


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